

AWARENESS OF SUSTAINABLE MANUFACTURING PRACTICES IN
MALAYSIAN MANUFACTURERS

SAMAN JAFARTAYARI

UNIVERSITI TEKNOLOGI MALAYSIA

Awareness of Sustainable Manufacturing Practices in
Malaysian Manufacturers

SAMAN JAFARTAYARI

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This paper is dedicated to my mother, Mrs. Maryam K., my father, Mr. Mansour J.T. and my sister, Sanaz who each gave the time and space for me to complete another chapter of my life and also to Marya L. for her sincere and help and support. Words cannot express my gratitude. Thank you for everything.

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ABSTRACT

This research is targeted at investigating all aspects of sustainable manufacturing awareness and practice level based on the 6R concept. Malaysian manufacturers have been assessed and categorized into electrical and electronics industries, engineering supporting and machinery industries, and other industries. There were four main objectives determined for this study: determining the level of awareness about the sustainability concept among Malaysian manufacturers, determining the companies' practices related to sustainability and proposing improving actions contributing to the sustainability enhancement of products and processes. For data collection, online questionnaire was used and there are six main sections use to help analyze the factors and find the correlations within the factors and their correlation with general information of the company and the person in charge of questionnaire. Six main sections that involved are general information, sustainability concept, three issues of society, environment and economics, energy saving and waste tracking methods, reusing- recycling - remanufacturing, life cycle activities and suggestions. General information and the conceptual questions were analyzed with descriptive analysis. Likert scaled questions were analyzed with mean score and correlation analysis (regression and ANOVA), Fisher test (for StD differences) and T-test (for mean differences). Lastly the survey results show that the level of awareness on sustainable manufacturing has direct relationship with the sustainable manufacturing practices. The sustainable awareness and practices related to most of the Rs (6Rs) is at a satisfactory level while in some of the Rs the practice levels seem to need attention.

ABSTRAK

Kajian ini bertujuan untuk mengkaji semua aspek kesedaran dan amalan bagi *sustainable manufacturing* berdasarkan konsep 6R. Syarikat-syarikat pembuatan Malaysia dinilai dan dikategorikan kepada industri elektrik dan elektronik, industri pemesinan dan sokongan kejuruteraan, dan lain-lain industri kandungan. Terdapat tiga objektif utama bagi kajian ini: mengkaji tahap kesedaran syarikat-syarikat pembuatan Malaysia tentang konsep *sustainable manufacturing*, mengkaji amalan syarikat yang berkaitan dengan *sustainable manufacturing* dan mencadangkan tindakan penambahbaikan yang menjurus kepada peningkatan *sustainable manufacturing* bagi produk dan proses. Bagi tujuan pengumpulan data, kertas soal selidik atas talian telah digunakan dan terdapat 6 bahagian utama bertujuan bagi menganalisis faktor-faktor dan mengkaji hubungan korelasi faktor-faktor tersebut serta hubungannya dengan maklumat umum syarikat dan juga individu yang bertanggung jawab terhadap kertas soal selidik. Enam bahagian utama yang terlibat adalah: maklumat umum, konsep *sustainable manufacturing*, masyarakat, alam sekitar, ekonomi, penjimatan tenaga dan kaedah pengesanan pembaziran, penggunaan semula, kitar semula dan pengeluaran semula, aktiviti-aktiviti kitaran hidup dan cadangan. Maklumat umum dan soalan-soal berkaitan dengan konsep dianalisis dengan menggunakan analisis deskriptif. Soalan-soalan yang menggunakan skala Likert dianalisis dengan skor min dan analisis korelasi (regresi dan ANOVA), ujian Fisher (bagi perbezaan StD), dan T-test (bagi perbezaan min). Keputusan kajian menunjukkan bahawa tahap kesedaran terhadap *sustainable manufacturing* mempunyai hubungan langsung dengan amalan *sustainable manufacturing*. Kesedaran dan amalan *sustainable manufacturing* yang berkait rapat dengan sebahagian besar daripada Rs (6Rs) berada pada tahap yang memuaskan namun terdapat juga beberapa Rs yang masih memerlukan perhatian.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENTS	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
	LIST OF APPENDIX	xiv
1	INTRODUCTION	1
	1.1 Introduction	1
	1.2 Research Background	2
	1.3 Problem Statement	3
	1.4 Research Objectives	3
	1.5 Scope of the Research	4
	1.6 Significant of the Research	4
	1.7 Thesis Organization	5
	1.8 Conclusion	6
2	LITERATURE REVIEW	7
	2.1 Introduction	7

2.2	Sustainability	7
	2.2.1 Green Product And Sustainable Product	8
2.3	Sustainable Assessment	9
	2.3.1 Life Cycle Assessment	9
	2.3.2 Brief Review on LCA	9
	2.3.3 Sustainability Elements	11
	2.3.4 6R Concept	14
	2.3.5 Material Flow, 3R and 6R Concept	15
	2.3.6 Measuring and Assessment of Product Sustainability	17
	2.3.7 A Generic Methodology For Assessing The 6Rs	19
	2.3.8 Evaluation of the Product Sustainability	21
2.4	Sustainability Perspective	24
	2.4.1 Concept of Sustainable Society	25
2.5	Reuse and Remanufacturing	26
	2.5.1 Estimating the Reliability Before Disassembly	27
2.6	Flow of the Comet Circle	29
2.7	Factorial Analysis	33
2.8	Likert Scale	33
2.9	Conclusion	34
3	COMPANIES PROFILE	35
3.1	Introduction	35
3.2	Industries in Malaysia	36
	3.2.1 Basic Metal Products Industry	36
	3.2.2 Electrical and Electronics Industry	37
	3.2.3 Electronic Manufacturing Services (EMS) Industry	39
	3.2.4 Engineering Supporting Industry	39
	3.2.5 Food Industry	43
	3.2.6 Machinery and Equipment Industry	43
	3.2.7 Medical Devices Industry	44
	3.2.8 Petrochemical and Polymer Industry	45
	3.2.9 Pharmaceuticals Industry	45
	3.2.10 Rubber-Based Industry	46

3.2.11	Textiles and Apparels Industry	47
3.2.12	Wood Based Industry	48
3.3	Conclusion	48
4	RESEARCH METHODOLOGY	49
4.1	Introduction	49
4.2	Methodology	49
4.3	Research Process	50
4.4	Survey Instrument	52
4.5	Data Collection	57
4.5.1	Treatment of Missing Data	57
4.5	Data Analysis	58
4.6	Conclusion	58
5	DATA COLLECTION AND ANALYSIS	59
5.1	Introduction	59
5.2	Data collection and response rate	59
5.3	Factorial Analysis	60
5.4	Data Analysis	63
5.4.1	General Information	63
5.4.1.1	Respondents' Positions	64
5.4.1.2	Industry Categories Of Our Respondents	65
5.4.1.3	Size of the Companies	66
5.4.1.4	Standard Certification	67
5.5	Score Mean Analysis for the Primary and Main Factors	72
5.5.1	Analysis of the main means score chart:	74
5.5.2	Correlation Analysis between factors	75
5.5.2.1	Correlation Analysis for Size of the Company	75
5.5.2.2	Correlations of Concept factor	79
5.5.2.3	Correlations of General Practices Factor (F3)	82
5.5.3	Suggestions received from the manufactures	84
5.6	Conclusion	85

6	Conclusion	86
	6.1 Introduction	86
	6.2 Project Summary	86
	6.3 Suggestions	87
	6.4 Future Research	89
	6.5 Conclusion	89
	REFERENCES	90
	APPENDIX A	93

LIST OF TABLES

TABLE NO.	TITLE	PAGE
2.1	Sustainability elements	24
2.2	Consumer survey on weighting sustainability elements	24
5.1	Response rate	60
5.2	Main factors and variables	61
5.3	R-value for correlations of size factor	75

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.1	Closed loop product life-cycle	9
2.2	Life cycle analysis (a) green product design; (b) 3 'r' strategy	11
2.3	Sustainability factors	14
2.4	Material flow and its interaction with 6rs	16
2.5	The product value (\$) over its life-cycle stages	17
2.6	The closed loop product life-cycle system	19
2.7	A generic scoring methodology for assessing the 6rs	20
2.8	Factor design framework for sustainable assessment	23
2.9	Results of consumer survey	25
2.10	Ccurrent reuse strategy	27
2.11	Maintenance data analysis	28
2.12	Two-step methodology for lifetime prediction	29
2.13	Concept of a sustainable society the comet circle tm	30
4.1	Methodology for Phase 1	51
4.2	Methodology for Phase 2	52
4.3	Online questionnaire snapshot 1	56
4.4	Online questionnaire snapshot 2	56
5.1	Respondents' position	65
5.2	Respondents' industry category	66
5.3	Size of the companies according to their industry type	67
5.4	Quantity of standard certificates in different industries	68
5.5	Percentage of certified companies with local and international	69

5.6	Percentage of raw material used in the studeied companies	70
5.7	Industry-wise raw material used in companies	70
5.8	Life cycle stages trackability	71
5.9	Life cycle stages trackability in different industries	72
5.10	Mean score of primary factors	73
5.11	Mean score of main factors	74
5.12	correlation chart between concept index and size of company	76
5.13	correlation chart between 3 issues factor and size of company	77
5.14	correlation chart between general practices and size of company	77
5.15	correlation chart between factor 4 and size of company	78
5.16	correlation chart between reduce (f5) and size of company	78
5.17	correlation chart between factor 6 and size of company	79
5.18	Correlation chart between 3issues and concept factor	80
5.19	Correlation chart between general practices and concpet	80
5.20	Correlation chart between factor4 and concept factor	81
5.21	Correlation chart between reduce(factor 5) and concept factor	81
5.22	Correlation chart between factor 4 and general practices	82
5.23	Correlation chart between reduce(factor 5) and general practices	83
5.24	Correlation chart between factor 6 and general practices	83
5.25	Improving suggestions of manufacturers	85

LIST OF APPENDIX

APPENDIX.	TITLE	PAGE
A	Questionnaire	93

CHAPTER 1

INTRODUCTION

1.1 Introduction

Achieving sustainable production or in an older perspective, green manufacturing, has become the main part in many companies' vision. The economical and environmental benefits obtained as a result of having sustainable processes and products, have put this issue in the center of attention during recent years. There have been many strategies to achieve this goal and many efforts have been done to increase the sustainability of the products and processes.

According to Jawahir et al., (2006a) there are six main contributing factors to the sustainability of the products and they coined the term 6Rs (Reduce, Reuse and Recycle Recover, Redesign, Remanufacture) to reflect them although traditionally a 3R concept (reducing resources, reusing materials, and recycling wastes and residuals were considered as a criterion for sustainability. Thus there are many factors related to sustainability of the products. The difficulty in assessment of sustainability was brought about in this point, due to the fact that measuring these factors and quantifying them to develop a sustainability index for the variety of the products requires an impeccable methodology supporting them all. Although many

methodologies are offered in the recent articles, none of them can act the role of an adjustable wrench in sustainability assessment. Therefore the issue needs more research since the need to a determinant sustainability index is felt more and more for different industries by the development of the technologies.

This study was started based on the target to find an assessment method for measuring industries greenness. The basic information for this study was to understand the level of awareness on sustainability issues among the manufacturing companies.

In order to investigate the level of awareness a research on sustainability elements should be performed in accordance with 6Rs (Jawahir et al., 2006a). This could cover the whole area of concern related to sustainability. Moreover, it would conclude separate indices of awareness for every individual R, helping future improvements needed for every individual factor. The indices can also be used for any legislation amendments required for as the infrastructure contribution to sustainability.

1.2 Research Background

Investigating the sustainability awareness is the thing that should be done in a broad range among the manufacturers. Due to the variety of Malaysian manufacturers and the extent Malaysian industries are developing. We have chosen categorized manufacturing companies according to MIDA. This is the study that has not yet done for local manufacturers in a wide area of sustainability covering the recently defined elements of sustainability.

Although there are many methodologies for assessing the sustainability of the products, a need to a simply implementable method for sustainable assessment is realized. The main data and the platform of this study is the data related to sustainability awareness level and the current practices performed for achieving the sustainability of the products and processes. By and large, the research on the local companies' awareness can help us to fulfill the requirements of the assessment models and make useful suggestions on sustainability improvements for machining oriented manufacturers.

1.3 Problem Statement

Nowadays, many companies practice the sustainability improvements in their processes. However comprehensive research has been conducted to investigate the level of their awareness and the degree they are practicing these methods. Moreover, this can give us the basic input for developing a good methodology of assessing the sustainability of the products and processes.

1.4 Research Objectives

There are three main objectives of the study;

1. To determine the level of awareness about the sustainability concept among the case study companies.
2. To determine the companies' practices related to sustainability.

3. To propose improving actions contributing to the sustainability enhancement of products and processes.

1.5 Scope of the Research

This research is targeted to investigating all aspect of sustainability awareness based on a the 6Rs proposed by (Jawahir et al., 2006a). This wide area of research can give us a broad perspective on the sustainability concept for developing an assessment methodology. The main sustainability assessment is aimed at the products of the local companies and the processes involved.

1.6 Significant of the Research

This research had categorized the significance of the research into four major groups. These four groups consist of Globe, Malaysia, studied companies, future research.

- a) Global

Any study contributing to sustainability enhancement can have direct and indirect impact on the environment. This can benefit the planet and human beings as a whole.

b) Malaysia

In general, this research will benefit Malaysia. Research like this is an approach that can suggest an improvement to increase the sustainability as a whole. The result of the study can help and also can be the guideline to the local industry to implement sustainability. Indirectly this research also will bring positive impact to improve the economy that also benefits Malaysian people.

c) Studied company

The questionnaire that will be distributed among the Malaysian manufacturers can give them a hint for future improvement. Since they will be asked about all the aspects of sustainability and also many details of the process sustainability are stated, they would be motivated to future enhancements.

1.7 Thesis Organization

This study consists of six main chapters. Chapter 1 is the introduction of the study. This chapter is about the research background, problem statement, research objectives, scope of the research and matters that related to the introduction of the research.

Chapter 2 is the literature review of the project. It describes the sustainability's definition, concepts, principle and tools that used in its assessment.

This chapter is the heart of the research. This literature will be the guideline to make sure the researcher keep on the right track in all the way completing the research.

Chapter 3 is Malaysian companies' profile and description of industries in Malaysia.

Chapter 4 is the research methodology. This chapter is describe the methods that will used by the researcher to conduct the study. This all includes data collection and method to do the data analysis.

Chapter 5 is result and data analysis while Chapter 6 is discussion, conclusion and recommendations of the research.

1.8 Conclusion

In this chapter the researcher has discussed on the initial parts that should be explained to enhance the understanding to the study. The next chapter will present the literature review which will be used in conducting the research.